

NON-PUBLIC?: N  
ACCESSION #: 9111210038  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Surry Power Station, Unit 2 PAGE: 1 OF 06

DOCKET NUMBER: 05000281

TITLE: Safety Injection/Reactor Trip From Vital Bus IVA Electrical Fault  
and Failure of Steam Generator Pressure Transmitter  
EVENT DATE: 08/02/91 LER #: 91-007-01 REPORT DATE: 11/12/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 092

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: M. R. Kansler, Station Manager TELEPHONE: (804) 357-3184

COMPONENT FAILURE DESCRIPTION:  
CAUSE: X SYSTEM: SB COMPONENT: PT MANUFACTURER: R369  
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

#### ABSTRACT:

At 1657 hours on August 2, 1991, with Unit 1 at 100% power and Unit 2 at 92% power, an Engineered Safeguards Feature actuated in Unit 2. A safety injection/reactor trip occurred as a result of a high steam flow signal coincident with a low steam line pressure signal. These conditions did not actually exist, but were generated by a combination of an erratic steam generator pressure channel and an electrical fault in a vital bus distribution panel. Troubleshooting was in progress on both problems, but the actuation occurred before corrective action could be completed. ESF functions performed as expected except for the failure of Emergency Diesel Generator #3 to achieve rated speed and the failure of the Containment Sump Pump Discharge Trip Valve (02-DA-TV-200A) to fully shut. A Notification of Unusual Event (NOUE) was declared at 1710 hours, and appropriate reports were made. On-shift operating personnel promptly placed the plant in a stable condition. The NOUE was terminated at 1840 hours. A Root Cause Evaluation of the Emergency Diesel Generator problem

is being conducted. The results of this evaluation will be reported in Licensee Event Report S1-91-017. A Component Failure Analysis of the Containment Sump Discharge Trip Valve has been conducted, and the results are included in this supplementary report. This event is reportable pursuant to 10CFR50.73(a)(2)(iv).

END OF ABSTRACT

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## 1.0 DESCRIPTION OF THE EVENT

At 1657 hours on August 2, 1991, with Unit 1 at 100% power and Unit 2 at 92% power, an Engineered Safety Feature (ESF) (EHS-JE) actuated in Unit 2. A safety injection/reactor trip occurred as a result of a high steam flow signal coincident with a low steam line pressure signal. These conditions did not actually exist, but were caused by an erratic steam generator pressure transmitter (02-MS-PT-2474) (EHS-SB-PT) and an electrical fault in Vital Bus Distribution Panel IVA (EHS-UJX-PL). Control and protection instrumentation for steam flow, feed flow, first stage turbine impulse pressure, steam generator (line) pressure, T-average control, pressurizer pressure control, steam dump control, and feed regulating valve "C" control are powered from the affected panel. Problems were first noted at 1441 hours when instrumentation powered by panel IVA began to experience perturbations.

Concurrent with the problems with the vital bus IVA instrumentation, steam generator pressure channel II failed at 1506 hours. Corrective actions were initiated for the failed steam pressure transmitter, and a spare transmitter had been located, but work on replacement had not begun because of the continued voltage fluctuations on vital bus IVA. The vital bus voltage fluctuations were under investigation at the distribution panel when the safety injection/reactor trip occurred. ESF functions performed as expected except for the failure of Emergency Diesel Generator #3 (EDG) (EHS-EK-DG) to achieve rated speed (835 RPM vice a minimum acceptable speed of 870 RPM) and the failure of the Containment Sump Discharge Trip Valve (02-DA-TV-200A) (EHS-BD-1SV) to fully shut. A Notification of Unusual Event (NOUE) was declared at 1710 in accordance with the Emergency Action Level Table, Tab M, "Miscellaneous Abnormal Events", and appropriate reports were made.

Subsequent to the initial ESF actuation, several more actuations occurred as a result of continued spiking of the channel IV instrumentation coincident with an actual low value of Reactor

Coolant System (RCS) average temperature (< 543 degrees F). On-shift operating personnel acted promptly to place the plant in a stable condition. The NOUE was terminated at 1840 hours.

## 2.0 SIGNIFICANT SAFETY CONSEQUENCES AND IMPLICATIONS

The loss of a portion of one of the vital buses is of minor safety concern because of the redundancy of the power supplies for the different

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channels of control and protection instrumentation. Reactor protective schemes have redundant channels and the power sources are provided from redundant vital bus cabinets. Because of the fail-safe circuitry of the reactor protection instrumentation, a power source failure to an instrument channel results in a trip signal from the affected channel. Multiple power supplies are provided to prevent a single power supply failure from initiating a false trip. In this case, a problem occurred on a component powered from one vital bus concurrent with instrument perturbations caused by voltage fluctuations on a second vital bus satisfying the logic for safety injection even though actual plant conditions requiring a safety injection did not exist. The system is designed so that if such a combination of events occurs, the Reactor Protective System (RPS) (EHS-JC) acts automatically to place the plant in a safe condition. If, for any reason, the RPS fails to function as designed, NRC-licensed operating personnel are trained to perform the necessary actions in accordance with the station's emergency operating procedures. During this event, ESF functions performed as expected except for the failure of EDG #3 to achieve rated speed and the failure of the Containment Sump Pump Discharge Trip Valve (02-DA-TV-200A) to fully shut.

Surry's emergency electric power system is designed to provide reliable power to engineered safety functions and other essential loads in the event of loss of off-site power (LOOP). The system consists of three 100% capacity diesel generator sets for the two Units. One generator is used exclusively for Unit 1 (EDG #1), the second for Unit 2 (EDG #2), and the third (EDG #3) functions as a backup for either Unit. Each Unit has two emergency buses normally fed from independent off-site power sources, with the EDGs functioning as on-site backup power sources. During this event, the off-site power sources remained available and fed the emergency busses. Although EDG #3 failed to achieve rated speed and would not have automatically loaded onto its bus, EDG #2 functioned as

designed and could have carried its emergency bus had the need arisen. Also, existing training and procedures guide the operator to take manual control, raise speed as necessary, and place EDG #3 on its bus.

Because there was no actual plant condition requiring safety injection and plant conditions remained normal, the failure of the containment isolation valve (02-DA-TV-200A) to fully shut had no adverse affect. Also,

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the redundant isolation valve outside containment (02-DA-TV-200B) functioned properly.

The health and safety of the public were unaffected during the event.

### 3.0 CAUSE OF THE EVENT

The event was caused by the intermittent loss of voltage to channel IVA protection instrumentation and a coincident low spiking of channel II steam generator pressure protection. The combination of these two conditions momentarily satisfied the high steam flow and low steam line pressure safety injection logic (two out of three high steam line flow signals coincident with two out of three low steam line pressure signals) and produced the ESF actuation. The cause of the problem in vital bus channel IVA was an inadequate electrical connection at the panel's main breaker with evidence of arcing at the contacts. The suspected cause of the transmitter failure was an internal short circuit using the instrument to fail high.

Subsequently, the shorting condition cleared, producing a negative change in voltage sufficient to trip the low pressure bistable, and make up the safety injection logic matrix.

### 4.0 IMMEDIATE CORRECTIVE ACTION(S)

Shift operating personnel placed the plant in a stable condition. The electrical connection to the input breaker to Vital Bus Distribution Panel IVA was found loose with intermittent contact occurring between the breaker and the vital bus panel bus bar. This connection was tightened and channel IVA instrumentation stabilized.

### 5.0 ADDITIONAL CORRECTIVE ACTION(S)

The Vital Bus Distribution Panel IVA input breaker was bench-tested satisfactorily and reinstalled. This breaker is a two-pole breaker with one pole in use at a time. The reconnection was made at the previously unused pole as a precaution. The three additional Unit 2 vital bus panels which had been installed during the same plant modification were checked for evidence of a similar condition. They were found to be satisfactory. A Root Cause Analysis was initiated to investigate this event.

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The failed pressure transmitter was replaced, and the defective instrument is being returned to the vendor for failure analysis.

EDG #3 was declared inoperable, and an investigation into its performance was initiated. The engine's Woodward UG-8 governor (EHS-DG-65) was found to be incorrectly set. The governor was returned to the proper setting, and the engine was tested and restored to operable status at 1000 hours on August 3, 1991.

A separate root cause evaluation of the EDG #3 governor problem is being conducted by a team consisting of corporate and key station personnel. Licensee Event Report S1-91-017 will be submitted based on the results of this evaluation.

The Containment Sump Pump Discharge Trip Valve (02-DA-TV-200A) was binding due to excessive spring tension on its valve seat. The valve was repaired, tested, and returned to service at 2132 hours on August 5, 1991. A Component Failure Analysis was performed on this valve with the following findings:

- Upon disassembly, the valve was found to have forty seat springs installed rather than the required number of twenty.
- The additional spring tension had created too much clamping force on the ball by the seats, preventing the valve from fully stroking.
- Although a revised vendor's drawing specifies the correct number of springs to be installed, the valve was last overhauled using a generic procedure which made no reference to this drawing. It is believed that when the craftsmen noted spaces for forty springs, they assumed that this was the correct number and installed them.

## 6.0 ACTIONS TO PREVENT RECURRENCE

The vital bus distribution panel main breaker finger connectors and incoming feeds will be inspected and retorqued during the next refueling outage for each unit.

Breaker maintenance procedures will be revised to include the manufacturers torque specifications for finger connectors.

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The circuit breaker and associated switchgear preventive maintenance program will be revised to periodically inspect and retorqued breaker electrical connections.

Any additional corrective action recommendations resulting from the Root Cause Evaluation will be evaluated and implemented as appropriate.

The station's Procedures Group has been tasked to prepare specific procedures for this valve and a number of others for which the generic procedures have been found to be inadequate. In addition, craftsmen will be given special training on the overhaul and rebuilding of the valves concerned.

## 7.0 SIMILAR EVENTS

Licensee Event Report S1-88-029-00, "Reactor Trip/Safety Injection Due to Spurious Hi CLS Signal as a Result of a Malfunctioning Relay".

## 8.0 ADDITIONAL INFORMATION

Failed components:  
Rosemount Transmitter (02-MS-PT-2474)  
Model No. 1153GB9

Crosby Ball Valve (2-inch) with Bettis Actuator

ATTACHMENT 1 TO 9111210038 PAGE 1 OF 1

Virginia Electric and Power Company  
Surry Power Station  
P. O. Box 315  
Surry, Virginia 23883

November 12, 1991

U. S. Nuclear Regulatory Commission Serial No.: 91-489A  
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Gentlemen:

Pursuant to Surry Power Station Technical Specifications, Virginia  
Electric and Power Company hereby submits the following Supplement to  
Licensee Event Report 91-007-00 for Unit 2.

REPORT NUMBER

91-007-01

Changes or additions to the original report are indicated by side bars in  
the right hand margin of the report.

This report has been reviewed by the Station Nuclear Safety and Operating  
Committee and will be reviewed by the Corporate Management Safety Review  
Committee.

Very truly yours,

M. R. Kansler  
Station Manager

Enclosure

cc: Regional Administrator  
Suite 2900  
101 Marietta Street, NW  
Atlanta, Georgia 30323

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